



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE BENEFITS OF THE APPLICATION OF CHEMISTRY TO THE OPERATION OF A SMALL FILTER PLANT¹

BY KENNETH HOLADAY²

One of the water utilities owned and operated by the Central Illinois Public Service Company is located at Harrisburg, Illinois, and includes a mechanical filtration plant of 1,000,000 gallons daily capacity. Although the raw water at this plant is very difficult to purify, no remarkable problems have been experienced nor have any new ideas of filter plant operation been developed. Only the tried methods of directing purification by laboratory tests have been followed. Since laboratory work is not applied rigidly, if at all, in many filter plants of this size, a comparison of the results obtained before and after the institution of this work as an aid to operation may be interesting to superintendents directing other small filter plants.

The Harrisburg plant was built in 1915. Although it is poorly arranged, none of the poor results obtained can be attributed to the type of the plant or its arrangement, except in so far as a poorly arranged plant is conducive to neglectful operation. But since the water is especially difficult to purify, and the operators have been men of no technical education, and no means of chemical control were provided, it is not surprising that, prior to the fall of 1919, the results were discouraging. The raw water is pumped from the Middle Fork Saline River, which is a small stream carrying the mine wastes of the coal mines of that district. Except during flood seasons, the water is very hard, high in sulphates, and often contains free acid.

Early in 1919 it was determined to secure satisfactory purification of this water if possible with reasonable effort. An inspection showed that there were no means of accurately determining either the total pumpage or the amount of chemicals applied. Much

¹Read before the Illinois Section, March 25, 1920. Discussions are requested and should be sent to the Editor.

²Chemical Engineer, Central Illinois Public Service Company, Mattoon, Ill.

alum and some lime were used as coagulants. The lime was applied in suspension, but was agitated in the tanks only at intervals and by hand, so that the actual dosage was very irregular. No laboratory tests were made whereby the amounts and proportions of coagulants could be determined. The operator used his own judgment as to the addition of the coagulants necessary to clear up the water. Consequently, the water was not always cleared. Most of the turbidity was removed, but the nature of the water is such that there was often a very difficultly removed residual turbidity which gave the appearance of a colloidal solution. The amount of alum used was excessive, and rendered the water unfit for laundering without softening. It also increased the natural tendency of the water to corrode pipes, meters, and fixtures. If one attempted to wash his hands in the water during almost any period between flood and low water when both the turbidity and concentration of mine wastes were fairly high, the excess alum would coagulate with the soap, forming a sticky film, which, when dry, produced a very harsh and most unpleasant feeling. The corrosive properties of the water caused much pump trouble, and large losses through dead meters and leaky fixtures. Since poor success tends to neglect rather than care, frequent interruptions occurred for various reasons, all fundamentally due to carelessness.

After thorough inspection of conditions at the plant, it was decided to extend the practices of large scale operation to this small plant as far as possible, especially with regard to recording operating conditions by means of laboratory tests.

An electrically driven stirring apparatus was arranged to agitate the lime solution so that the dosage would be regular. Depth gages were placed on all solution tanks. A recording depth gage was provided to measure the raw water flowing over a weir into the plant. The laboratory, which had been built in the plant, was equipped for making tests of turbidity, color, alkalinity, free carbon dioxide, and chlorides, bacterial agar counts, and gas former tests. The chief operator of the plant was instructed in the manipulation, purpose, and interpretation of the tests as set forth in a set of specially prepared, detailed instructions. Standard solutions and bacterial media were shipped to Harrisburg from the laboratory of the company's Lawrenceville plant. It was later found more convenient to have the Harrisburg operator prepare his own media. He has been able to interpret intelligently the results of the laboratory

tests, and he attributes his success in improving the quality of the filtered water largely to the information they have furnished.

Charts showing the relation of turbidity to the amount of alum necessary for purification were found very useful in determining the dosage of alum. The dosage of lime is regulated by the alkalinity of the raw water, and the amount of alum applied.

The water is still rather hard, but not so much so as to be very objectionable. The laboratory work has shown the operators what an interesting process water purification is, and has made the operation of the plant sufficiently interesting to them so that it no longer seems a hardship to be constantly alert.

The changes in operating methods and means of controlling and recording the purification processes, as mentioned, have been in full force only since last September, so that it is not possible to say that the difficulties of the summer season, when the mine wastes furnish practically the only flow in the stream, have been overcome. Yet the nature of the impurities is the same throughout the year, only modified in the different seasons, and the improvement in the quality of the filtered water of last winter over that of previous winters has been so encouraging that there is little doubt that proper attention to the tests and vigilant operation according to their results, such as is now practiced, will successfully purify the water which flows through the creek in any season.

In the large plant, close chemical control is obviously a necessity, because it not only insures the continuous production of water of a good physical and sanitary quality, but also effects an appreciable financial saving by reducing to a minimum the amounts of coagulants and sterilizing agent applied, and affords an accurate record of production, which is as necessary to a successful water supply business as to any other manufacturing enterprise. In the small plant, treating 1,000,000 gallons or less daily, these several advantages of chemical control are not, theoretically, of sufficient importance to warrant additional investment in equipment and supervision necessary for daily chemical and bacteriological examinations. The experience with the Harrisburg plant, however, has convinced the company that there are other losses than the wasting of a few pounds of chemicals per day, losses due to irregularities of plant operation, which might be eliminated by laboratory control and which accumulate rapidly enough to waste the price of a laboratory in a very short time.